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AUTHOR Doeksen, Gerald A.; And Others
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ABSTRACT

Extension personnel can aid rural decision makers with impacts felt from rapid growth in their communities via a locally applicable community impact model. This paper illustrates how extension professionals can utilize community impact models. Impact models reviewed include: model to measure the impact of new industry on rural communities in Oklahoma, which provides results of private impacts, public sector impacts, and school district impacts; a computer model that is designed to describe the impacts of locating large power plants near small, isolated communities; a Florida impact model which ia an ex ante evaluation of the impacts of community growth; a North Dakota model designed specifically to measure the impact of energy developments; and the Oklahoma State University (OSU) community impact model, which contains all the components extension agents feel are needed to be useful, i.e., it's dynamic, community specific, and easy to adapt to each community. Although the report provides a brief review of impact models, a wide range of methodologies exist. It suggests that developing new and innovative methodologies is necessary to continually improve the models used, and that adaptation of existing models provides additional checks on model validity. (AH)

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COMMUNITY IMPACT MODELS--
A RESEARCH AND EXTENSION CHALLENGE

by

Gerald A. Doeksen*
Mike Woods
James R. Nelson

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*Professor, Research Assistant, and Associate Professor, respectively, Department of Agricultural Economics, Oklahoma State University, Professional Paper Number P 1066 of Agricultural Experiment Station.

COMMUNITY IMPACT MODELS --
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During the 70's, for the first time in 160 years, rural areas and small towns had a higher growth rate than metropolitan communities. Preliminary 1980 census figures indicate that nonmetropolitan counties increased by about 15 percent whereas metropolitan counties increased by about 9 percent from 1970 to 1980 [1]. Many mining, resort-retirement and urban fringe counties grew by 40 to 50 percent or more. On the other extreme, nearly 500 of the 2485 nonmetropolitan counties continued to decline in population during the 1970's [10].

Decisionmakers in rapidly growing communities are under severe pressures to plan for growth. Planning community services often entails large capital outlays and, thus, it is important to base plans on available employment, income and population information. A mistake of building a water or sewer treatment plant too large or too small can be very expensive and embarrassing to elected officials. Similarly, decisionmakers in declining or stagnating rural areas need to properly plan so that their scarce resources are efficiently allocated.

Extension personnel can aid local decisionmakers with a locally applicable community impact model. The objective of this paper is to illustrate how Extension professionals can utilize community impact models. More specifically the objectives are:

1. to review several community impact models;
2. to illustrate the application of a community impact model; and

3. to discuss the Extension challenge of delivering community impact models.

The Research Challenge

Impact models describe economic and demographic changes which affect both the public and private sectors. Estimated impacts of rapid growth or decline represent useful information for community decisionmaking. Most impact models are ex ante in nature, providing projections before the impact occurs. The alternative is ex post impact analysis which describes the impact after it has occurred. With shifting populations, economic changes and energy development, reliable ex ante impact models are increasingly useful.

Brief Review of Some Impact Models

Many types of models and methodologies have been developed. These range from economic base analyses to complicated community simulation models. Shaffer and Tweeten [11] present an early version of an impact model developed to measure the impact of new industry on rural communities in Oklahoma. The model provides results of private impacts, public sector impacts and school district impacts. A framework for calculating net gain (loss) to the community was also included in order to estimate reasonable "inducement" levels that communities might offer potential manufacturing employes. The model is notable because of the emphasis placed on making it usable and understandable to local leaders. The model utilizes partial budgeting techniques and is a single period tool with no dynamic time considerations. Shaffer and Tweeten note the difficulty of estimating the indirect and induced effects at the community level because there are no published rural community input-output tables. Two conclusions reached by the authors are that industrial impacts

vary over different economic sectors and differ among communities.

Ford [4] presents a computer model that is designed to describe the impacts of locating large power plants near small, isolated communities. Small towns in the western states that experience this type of impact generally go through an initial "boom" period with rapid expansion. Following the initial construction phase, economic and demographic changes tend to level off. Characteristics of the immigrating population during the construction phase are often quite different from the characteristics of the indigenous population. Public service capital and economic activity are often expanded to support the rapid population growth putting a strain on the public sector. Following completion of the energy project, a "bust" period often follows. Tax revenues decrease and the local government is left with excess capacity in the public sector. The BOOM 1 model [4] provides economic, demographic, public service, and fiscal projections of the proposed impacts. Yearly projections for the city of interest are provided. A series of feedback loops are utilized to provide dynamic projections from year to year.

Clayton and Whittington [2] present an impact model developed for use in the state of Florida. The model is an ex ante evaluation of the impacts of community growth. Output includes employment and population change resulting from an outside impact such as a new industry. Private sector impacts include such variables as direct, indirect and induced sales from the impact being analyzed. Public sector impacts include projection of local revenues and expenditures. A net fiscal surplus (deficit) is calculated along with a break-even property assessment ratio. City, county, and school district levels of government are included. The Florida model emphasizes user access with default data provided when local data are unavailable. This type of data

availability increases the usefulness of the model and allows more timely analysis.

A more recent model has been developed in North Dakota [6] which is designed specifically to measure the impact of energy developments. The model provides annual impact and baseline projections of key variables. Impacts of energy resource development can be measured for employment, population, settlement patterns, school enrollments, housing requirements, and public sector costs and revenues [2]. Like the model for Florida, the North Dakota model is built around the input-output portion of the model. Output is provided at the state, county, city and school district levels. Also, the complex process of interfacing economic projections with population growth is well documented.

Model adaptation is the process of taking a model used in one area and applying it to another area. This process can be successfully accomplished if care is taken to replace original data with more appropriate data for the new area being considered. This can take considerable time, but may be considerably more efficient than developing a new model from "scratch". Examples of model adaptation include a model developed for Virginia [8]. The Virginia model draws from the work of Shaffer and Tweeten [11] and provides similar output. Another adaptation is the model developed for Texas [9] which follows the methodology developed in the North Dakota model.

Fox [5] discusses the development of impact models from a user's viewpoint. Governments at all levels are faced with decisions that would be greatly aided by impact model forecasts. Fox emphasizes the fact that user confidence will be enhanced by more accurate and useful models, thus increasing clientele support. For users to utilize models to best advantage, they need to understand the basic model assumptions and structure. If information is clearly communicated to the layman users, then less misinterpretation will occur. Users should be encouraged to ask as many questions as necessary to understand the model.

As can be seen from a very brief review of impact models, a wide range of methodologies exists. Some models measure energy resource development impacts, some measure the results of industrial development. Some impact models can also project baseline growth to compare to the resulting growth from some outside impact. Developing new and innovative methodologies is necessary to continually improve the models used. Adaptation of existing models provides additional checks on model validity. Model builders should utilize the 1980 Census results to improve and verify modeling efforts. It is critical for the successful utilization of all impact models to make outputs usable and understandable for decisionmakers. From the viewpoint of an Extension worker, a model which is useful should be: (1) dynamic; (2) community specific; and (3) easy to adapt to each community.

A community impact model has recently been developed at Oklahoma State University (OSU) which relys heavily on the works referenced above [12]. To facilitate Extension application, special efforts have been made to make the model dynamic, community specific, and easy to adapt. The OSU model is discussed in detail in the following section.

The OSU Community Impact Model

An aggregate overview of the OSU community impact model is presented in Figure 1. The model has four main sections: an economic account, a capital account, a demographic account and a government account. The economic portion of the model is the driving force of the model. It includes a community specific input-output model and a gravity model. The gravity model is employed to determine the service area of a community. A location quotient technique is applied to a regional or state input-output model to derive a community specific input-output model. The community model is made dynamic through the use of equations which predict final demand over time.

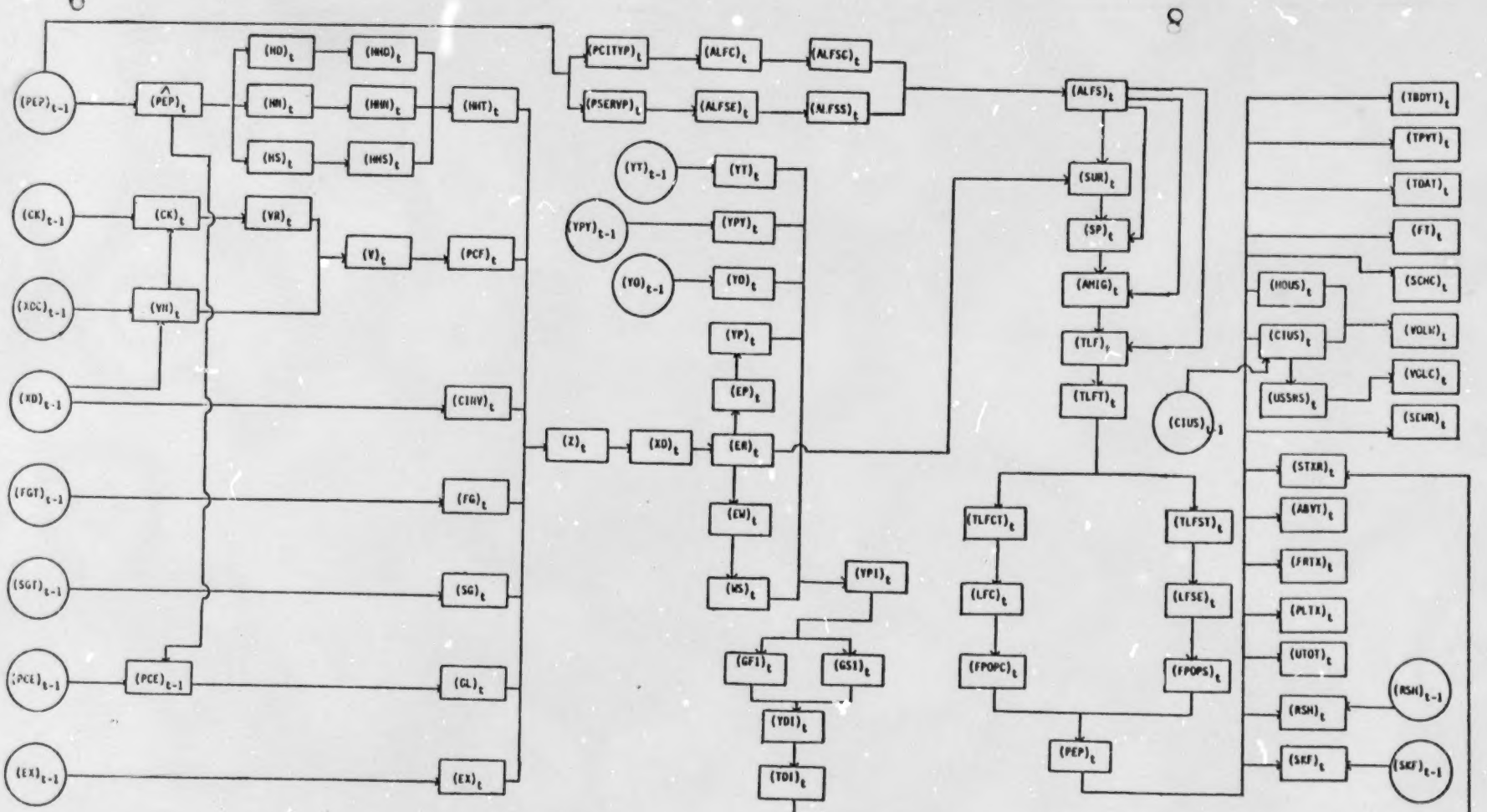

Figure 1. Flow Chart of the Simulation Model for Rural Communities in Oklahoma

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A capital account allows for the simulation of capital investment and its effects on the economy. The demographic portion of the model is a typical birth, death, population projection model with migration being an equalizer to match up people with available jobs in the economic sector. The government sector estimates the need for services based on community service usage coefficients.

To illustrate the model, a recent application is presented. The community simulation and impact model was applied to the community of Holdenville, Oklahoma. The model simulated values for economic and demographic variables by year from the base year of 1972 to 1991. Projections of employment for selected years are presented in Table 1. Many of the future jobs are expected in the service type sectors of wholesale and retail trade, finance and insurance and educational and professional services. Proprietor employment is projected to increase slightly. The model projects population by age and sex categories. Aggregate data for the community and for the service area are shown in Table 2. Population is projected to increase from 8,756 in 1972 to 11,182 in 1990. The 1980 population was projected at 8,939. Preliminary 1980 census data show a population of 9,201.

The government component, which predicts service needs, is probably the most useful section of the model. Projected community service needs for the Holdenville area are shown in Table 3. Hospital bed days are projected to increase from 16,508 in 1980 to 19,319 in 1990. These estimates are based on estimated population by age and sex and hospital utilization rates for each age and sex category [7]. For each community service, detailed research has been completed to facilitate usage prediction based on local conditions.[1] An estimation of general fund revenue which will be available to Holdenville to

[1]For a summary of community service studies, see [3].

TABLE 1

PROJECTED EMPLOYMENT BY SECTOR FOR HOLDENVILLE, SELECTED YEARS*

Sector	Year				
	1972	1975	1980	1985	1990
Agriculture, Mining	164	184	220	273	343
Construction	34	62	63	98	156
Manufacturing-Nondurable	178	153	117	109	109
Manufacturing-Durable	1	143	121	142	168
Transportation	25	30	30	34	41
Communication, Utilities	60	43	30	30	31
Wholesale and Retail	252	312	365	493	693
Finance, Insurance and Real Estate	256	298	355	461	616
Educational and Professional Services	629	703	803	989	1262
Total Wage and Salary	1599	1928	2104	2629	3419
Total Proprietor	1112	1161	1106	1125	1133
TOTAL	2711	3089	3210	3754	4552

*Source [12]

TABLE 2

PROJECTED FOPULATION FOR HOLDENVILLE AND SERVICE AREA, SELECTED YEARS*

	1972	1975	1980	1980[A]	1985	1990
HOLDENVILLE	5222	5388	5215	5373	5662	6397
SERVICE AREA	3534	3723	3724	3828	4152	4785
TOTAL	8756	9109	8939	9201	9814	11182

[A]PRELIMINARY CENSUS DATA

*SOURCE [12]

TABLE 3

PROJECTED COMMUNITY SERVICE NEEDS FOR HOLDENVILLE AND SERVICE AREA, SELECTED YEARS*

Community Service	Year				
	1973	1975	1980	1985	1990
Hospital Bed Days	16,364	17,163	16,508	17,536	19,319
Physician Visits (Clinic)	30,744	32,240	31,565	34,535	39,224
Ambulance Calls					
Holdenville	227	240	233	244	261
Service Area	108	118	124	140	162
Total	335	358	357	384	423
Fire Calls					
Holdenville	83	86	84	91	103
Service Area	56	60	60	66	77
Total	139	146	144	157	180
Water[A] (Thousand Gallons per Year)	168,600	176,158	170,764	135,893	209,486
Sewer[A] (Gallons per Day)	519,328	541,656	524,553	569,796	643,512
Solid Waste[A] (Cubic Yards per Week)	389	406	393	427	483

[A]Holdenville community only.

Source: [12]

support additional services and other local government functions was made for each year from 1972 through 1991. Annual revenues for selected years are presented in Table 4.

The data in Tables 1 through 4 reflect growth as is currently occurring in the area and can be referred to as "base run" information. If a new plant or some other development activity was expected, its impact could be simulated. For example, assume a new plant employing 50 workers is expected to locate in Holdenville in 1982. The community simulation and impact model can be run and comparisons of the estimates made with base year estimates to measure the impact of the plant. Selected impacts measured in this way are presented in Table 5. The simulation model projects wage and salary employment to increase by 115 in 1982 and by 210 in 1990 due to the new plant. Likewise, physician visits are projected to increase due to the plant by 744 in 1982 and by 1233 in 1990.

A major function of the OSU community impact model is to allow decision-makers to estimate the impact of a change in their community's economy on community service needs and community revenues. They can then determine when the capacities of existing systems will be reached and what capacities should be designed into system constructions or renovations. If researchers are to continue serving community decisionmakers, we must constantly strive to improve our abilities to simulate and predict the impacts that changes will have on communities.

The Extension Challenge

Several aspects of the delivery of community impact information to local decisionmakers are critically important to Extension workers. Community simulation and impact models must be easily adaptable to specific communities, and

TABLE 4
PROJECTIONS FOR GENERAL FUND REVENUE FOR
HOLDENVILLE SELECTED YEARS*

Revenue Source	Year				
	1973	1975	1980	1985	1990
	Thousands of Current Dollars				
Sales Tax	201	266	448	796	1,457
Alcoholic Beverage Tax	304	317	307	334	377
User Charges and Other	196	208	202	224	474
TOTAL	701	791	957	1,354	2,084

Source [12]

TABLE 5

PROJECTED IMPACT FROM 1982 TO 1990 FOR SELECTED YEARS DUE TO NEW PLANT LOCATION IN HOLDENVILLE IN 1982*

	1982	1985	1987	1990
Wage and Salary Employment	115	153	180	210
Population[A]	209	283	320	350
Hospital Bed Days[A]	410	539	596	634
Physician Visits[A]	744	1004	1130	1233
Ambulance Calls[A]	9	12	14	15
Fire Calls[A]	3	4	5	5
Water[A] (Thousand Gallons Per Year)	6802	9144	10284	11856
Sewer[A] (Gallons Per Day)	21022	28450	32065	35414
Solid Waste[A] (Cubic Yards Per Week)	15	22	24	26
General Revenue (1000$)	33	46	55	74

[A]Holdenville community only.

*Source [12]

they must be accessable for quick delivery. The OSU community simulation model is programmed with default data. Thus, if local data are not available, values of variables in the model will be used. The model requires base year data for employment, population and miles from neighboring communities. Once these data are entered, it can be run for any community. Default data can easily be changed if local decisionmakers have more accurate local data.

It is usually important to respond to information needs of local decision-makers as rapidly as possible. The OSU model is written to facilitate rapid output of information which can be readily compiled into a community report. OSU personnel attempt to complete analyses within 2-4 weeks of a request. Then, a computer terminal is taken to the field when the study is presented so that additional community simulation runs can be made if local decisionmakers wish to change certain variables.

Another important element of the successful delivery of information from the OSU community impact model is to leave several copies of the final report with community leaders. This provides them with a reference for future use and also makes them more aware of Extension's services. It is also often seen by community leaders of other communities, resulting in more requests and building Extension's clientele. In summary, as Extension workers, we need to provide (1) community specific analyses; (2) quick responses to community requests; and (3) written reports of results of analyses to each community. Used in this way, community impact models will serve to build an Extension clientele as assistance is given to leaders of rural communities.

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